Welcome to BIOS 424/524 Microbiology & Biotechnology

We must go virtual for the first two weeks of classes, via Zoom

Here I list the overall learning outcomes for the course and course details, including meeting dates and locations, instructor information, grading, textbook, overall organization of the course, review sessions, policies on absences, group work, and the honor code, information for students with disabilities or Title IX concerns, and specific information for **BIOS 524 students**.

- For this semester's course schedule click here
- For details on group work, papers, and oral presentations click here
- In Files you will find lists of discussion/presentation topics

Please contact me via email about any other issue(s) that may affect your ability to achieve the objectives of this course, such as concerns about your physical or mental health, excessive demands on your time, evidence of racial, ethnic, gender or other forms of inappropriate discrimination, sexual harassment, etc.

Course outcomes

1. Be able to analyze and define the key structural, energetic and metabolic processes occurring in various ecological niches and the interactions among microbes and other organisms in such environmental communities.
2. Understand the contributions of environmental parameters and genetics underlying efficient and economic industrial production of various products by native and engineered microbes.
3. Develop knowledge of the microbial processes used in production of various foods and the molecular basis of diagnostic test systems used for industrial optimization and monitoring, environmental assessment and health diagnostic applications.
4. Be able to analyze and communicate key factors about pathogenic agents and the mechanisms by which they create disease symptoms and be able to consider appropriate methods for treatment, public health response and impact of major types of infectious diseases.

An often unstated outcome of any course is to develop enthusiasm for the subject, including a desire to learn more. See here for a scenario that places the study of microbial organisms and how they might work for us in a fanciful futuristic context.

Course details

Course details may be changed, with reasonable notice, at the discretion of the instructor.

Meetings: Classes will be held Tuesdays and Thursdays remotely 9:25-10:40 am from Jan 11 through Jan 20, then in-person from Jan 25 through Apr 21 in KWG 100 (Keith-Weiss Geological Laboratory Building).

Instructor: David Caprette, caprette@rice.edu, x3498, Office in ABL 102B

Office hours: My schedule is too complicated to make regularly scheduled hours work. Let us please arrange meetings via email. Meetings can be in-person or via Zoom.

Course grade: There will be three midterm exams, all counting equally for a total of 63% of the final course score. Three written reports on selected topics will also count equally for a total of 27% of the final score. There will be one oral presentation, for 10% of the final score. There is no final exam in this course.

Textbook – Microbiology, an evolving science 4th Ed. (Norton pub). The goal of the assigned readings is to gain a broad view of essential themes in microbiology, and to cover material important for a sound background in microbiology. General aspects of the material and microbiological terms will show up on exams. Other versions of the text or other microbiology texts are ok but the syllabus refers to the pages of the 4th edition. Note that a 5th edition is now available. You are welcome to purchase it, however the 4th will do fine. More copies of that edition should be available used, and cheaper!

Organization of the course: The objective of the course is to understand the roles of microbial organisms, primarily bacteria, in the environment, industry, and in human health. This course employs two more major learning resources in addition to the text.

- ***Lectures.*** The lectures will present and reinforce important concepts or areas of information and be correlated with the text where that area is adequately covered in the book. I will not just reiterate the text but will selectively emphasize certain topics and certain areas that bridge various topics from the text or go into underlying mechanisms of processes in more detail. Lecture slides and extra material will be posted in Files.
- ***Student discussion and literature research on selected topics.*** The goal of this part is to enhance your abilities to pull important information out of the literature and to work in a group to organize, review and present a topic in appropriate depth in a short time. Multiple groups will work on their selected topics in each section of the course and present a narrated or captioned presentation to be posted on the course website. Each presentation will be reinforced with individualized written reports of subtopics. This project resembles that of a task force, advisory panel, or public interest group organized to generate a business briefing, governmental report, presentation to health workers, or a public affairs program.

Review sessions: In the class schedule you will find class periods designated as review times. These will be question and answer sessions and can also be used to make up for lost class days, which we have experienced far too often recently.

Absence policies: Please contact me about absences due to illness, out-of-town travel, or other situations that are beyond your control. You are expected to be present during regular class time.

Group work: You are expected to work with other students on projects that require outside class time. Please notify me if:

- you have trouble scheduling group meeting times that include all team members
- one or more members decline to participate, and/or
- you find yourselves without enough students in the group due to drops

Honor code policy: Rice University's Honor Code policies (http://honor.rice.edu/) apply to this course. All exams and assignments will be considered pledged and must be completed in the time allotted unless arrangements are made ahead of time. Policies in Rice University's General Announcements apply to this course.

Students with disabilities: If you have a documented disability that will impact your work in this class, please contact Disability Support Services (http://dss.rice.edu/) I will make accommodations as advised in the letter that they prepare for you. Please speak to me during the first two weeks of class so that I can make appropriate plans. All discussions will remain confidential.

Title IX policy: At Rice University, unlawful discrimination in any form, including sexual misconduct, is prohibited under Rice Policy on Harassment and Sexual Harassment (Policy 830) and the Student Code of Conduct.

- Please be aware that all employees of Rice University are "mandatory reporters," which means that if you tell me about a situation involving sexual harassment, sexual assault, dating violence, domestic violence, or stalking, I must share that information with the Title IX Coordinator.
- Although I have to make that notification, you will control how your case will be handled, including whether or not you wish to pursue a formal complaint. Our goal is to make sure you are aware of the range of options available to you and have access to the resources you need.
- To report sexual harassment, please contact the Title IX Coordinator at titleix@rice.edu. To explore supportive measures and other resources that are available to you, please visit the Office if Interpersonal Misconduct Prevention and Support at https://safe.rice.edu.

BIOS 524 students: Graduate students in BIOS 524 students will do an additional term paper of ~12 pages on a microbiological topic decided upon after discussion with the instructor. This paper will count for 20% of the grade. This will be of the style of the shorter group subtopics but broader and with more depth. It can be on most any topic but not overlapping closely of one of the short papers. It could be one on of the topics listed or another topic the student wishes to cover. The term paper will be due the last day of finals. Eighty percent of your course score will consist of the regular class grade as outlined above. Your term paper will account for the remaining 20%.

BIOS 424/524

Schedule of activities – Spring 2022

This schedule is subject to change, with sufficient notice of course. Perhaps we will be lucky this semester and not lose any class days to weather or other circumstances.

Class	Date	Lecture topic	Assignment	Text reading
1	Jan 11	Course introduction; Part 1: microbial cell types and structures		Ch. 3
2	Jan 13	Part 2: general types of microbial metabolism & metabolic reactions; photosynthetic, sulfur reducing, fermentative organisms; cellular respiration; nitrogen fixation	Begin phase 1 of topic 1 – prioritize topics, organize groups	Ch. 14, 14, 15
3	Jan 18	Continue microbial metabolism, begin Part 3: culture methods; microenvironments; sewage treatment; biogeothermal cycles; molecular classification		Ch. 14, 14, 15
4	Jan 20	Continue with Part 3, begin Part 4: bacterial surface interactions, including biofilms, adhesion processes, sensing the extracellular environment, and exoenzyme production	Phase 2 of Topic 1: Turn in group outline and names of designated presenters	Ch. 18, 19, 21, 22
5	Jan 25	Continue Part 4, begin Part 5: symbiosis and intracellular growth, including plant/bacterial/pathogen interactions, symbiotic associations, intracelluar growth of microorganisms in animal cells	Turn in individual reports for Topic 1	Ch. 18, 19, 21, 22
6	Jan 27	Finish Part 5		pp. 144, 666-670, 798-801, 820-822, 845
7	Feb 1	Oral presentations	Turn in presentation for Topic 1	
8	Feb 3	Oral presentations and review session		
9	Feb 8	EXAM 1		

10	Feb 15	Start Part 6: industrially useful bacterial and fungal strains, including food microbiology, mutations and mutant strains, mutants for increased antibiotic production, microbial contributions to screening for new drugs	Begin phase 1 of topic 2	Ch. 5, 12, 16 1112-1115
11	Feb 17	Continue Part 6, Part 7: measurement and control of bacterial growth, begin Part 8: Fermentation and production processes, including applications, production and growth cycles, equipment, optimization and scale-up, and downstream processing	Phase 2 of Topic 2 Turn in group outline and names of designated presenters	pp. 650-660
12	Feb 22	Finish Part 8, begin Part 9: microbial products, including small acids and alcohols, amino acids, vitamins, nucleic acids, antibiotics, steroids, carotenoids, and polymers		Ch. 16
13	Feb 24	Part 9, continued	Turn in individual reports for Topic 2	Ch. 16, 12
14	Mar 1	Finish Part 9, begin Part 10: Recombinant DNA technology		Ch. 12
15	Mar 3	Finish Part 10 Oral presentations	Turn in presentation for Topic 2	
16	Mar 8	Oral presentations		
17	Mar 10	EXAM 2		
18	Mar 22	Part 11: Clinical and diagnostic microbiology – sampling and testing techniques	Begin phase 1 of Topic 3	Ch. 28, pp. 1147-1170
19	Mar 24	Part 12: microorganisms associated with humans		Ch. 23, 25
20	Mar 29	Part 13a: microbial diseases, including the origins of medical microbiology and disease-causing organisms including Streptococcus, Mycobacteria, Corynebacteria, Legionella, Bordatella, STDs, and Rickettsias	Turn in group outline and names of designated presenters	Ch. 26
21	Apr 1	Part 13b: microbial disease continued, including plague (Yersinia), roles of Staphylococcus, Enterobacteriaceae, Helicobacter, and other bacteria in food-borne disease, toxic shock syndrome, cholera, botulinum toxicity, tetanus, anthrax, and other pleasantries	Turn in individual reports	Ch. 26

22	Apr 5	Part 14a: viruses, including types, animal viruses of disease, retroviruses, slow virus infections, and vaccines	Turn in individual reports	Ch. 26 & Ch 11
23	Apr 7	Part 14b: viruses, continued		Ch. 26 & Ch 11
24	Apr 12	Parts 15 & 16, disease transmission and anti-microbial agents	Turn in presentation for Topic 3	Ch. 27, 28, pp. 1171-1183
25	Apr 14	Oral presentations		
26	Apr 19	Oral presentations and review		
27	Apr 21	Exam 3		

Presentations and papers

The goals of these assignments are to enhance your abilities to pull important information out of the literature and to work in a group to organize, review and present a topic in appropriate depth in a short time. Multiple groups will work on their selected topics in each section of the course and present a narrated or captioned presentation to be posted on the course website. Each presentation will be reinforced with individualized written reports of subtopics. This project resembles that of a task force, advisory panel, or public interest group organized to generate a business briefing, governmental report, presentation to health workers, or a public affairs program.

Summary of assignments

At the beginning of the course and again following the first and second midterm exams we will organize the class into teams. Each team will develop a presentation on a topic selected from the list posted for that general area – environmental, industrial, or medical. Each individual will make a unique contribution to the team presentation, including an individual report on that team member's subtopic. For each presentation, each team will select one or two members to give an oral presentation so that every student gives one oral presentation during the course.

This means that each of you will help develop a total of three team presentations, prepare three papers, and give one oral presentation. Here is an outline of the process.

Team presentations phase 1

We will start by forming groups to cover each of the topics based upon the preferences you indicate in the survey in Quizzes. The groups will gather information with the aid of the text, lectures, primary literature, online searches, and any other sources the group may select,

document all sources, collect and organize references. ***During this period each group will assign specific portions of the topic for each student in the group to read in depth and report to the other members of the group via online communication within the next week.***

Team presentations phase 2

Each person should have an individual outline and notes on the main points to cover in the individual write-up. Teams will select PowerPoint presenters for the topic and define areas to be covered by each speaker. ***At the end of the second phase, a <u>detailed</u> outline of the group's subtopic will be prepared and turned in by e-mail to me (caprette@rice.edu), including the specified area and portion of the PowerPoint to be presented by each designated speaker.*** These outlines will be posted on the course website as will the final presentations. Each individual will incorporate suggestions for improvement made by others in the preparation of their individual written reports. Reference to the overall outline will help each writer to try to fit his/her own subsection into the context of the theme of the entire group. ***Approximately one week after the second phase is completed, the written reports prepared by the individuals will be turned in. See schedule.*** Copies of these reports should also be given to the appropriate group speakers beforehand along with any special figures useful to the presentation.

Written reports

These reports should be about two-and-a-half pages long including images and diagrams and single-spaced. Each should contain (i) a brief introduction which covers the general topic of your group and leads into your specialized sub-area of the topic, (ii) a concise summary of the key points about your individual subtopic supported by specific details, references and/or diagrams, (iii) a concluding statement, (iv) list of references cited, (v) a sentence describing the most interesting new thing you learned in preparing your report and a sentence on an item you learned from another group member or a connection you contributed to another group member's report during the team's coverage of the topic. These reports should be given to the speaker from your group along with extra information and visuals you found that could aid the speaker in covering your subtopic.

The oral presentation

A typical oral presentation will be approximately 7 minutes long for each person, once during the term. With a group size of 6 students we should aim for two presenters per PowerPoint presentation. The text and illustrations should clearly present background on the topic as well as the key scientific points. Appropriate sources of illustrations should be included on the slides. The presentation will be graded on content, clarity, organization, and response to questions. We will plan to post the outlines and presentations on the canvas site for the class to see before each exam. One or more exam questions are likely to come from each team presentation. You will want to take about 15 min to review each one.